# Modelling for product design and optimisation: CFD

## At a glance

To authenticate fuel products in situ, Authentix are developing a field-based analyser where speed of analysis is an important factor. Part of their device is the fuel-water splitter. Authentix wanted to investigate the performance of the separation chamber to improve its operational efficiency.

Computational Fluid Dynamics (CFD) was used by STFC Daresbury's DAComS Laboratory to investigate the flushing characteristics of the separation chamber. The lab were able to make specific recommendations for optimising the chamber geometry which would allow Authentix to reduce the residence time by up to a factor of five.

Simulation showed that simple design modifications could provide a significant improvement in operational efficiency of a device.

## Challenge

Authentix are a global leader in product authentication working with the petroleum, pharmaceutical and consumer industries. They provide diagnostic services to protect organisations from loss of revenue through counterfeit goods or loss of quality as goods transit the supply chain.

To authenticate fuel products in situ, Authentix are developing a field-based analyser where speed of analysis is an important factor. An important part of their device is the fuel-water splitter which separates the incoming fuel and water into individual components, prior to detection of a specific marker.

Authentix wanted to investigate the performance of the separation chamber to improve its operational efficiency.

## Approach

The Centre for Microfluidics and Microsystems Modelling (C3M) used computational Fluid Dynamics (CFD) to investigate the flushing characteristics of the separation chamber, with the objective of reducing the analysis time of the fuel analyser.

The challenge was to reproduce the performance of the existing prototype and then make design recommendations on how to improve the efficiency of the separation chamber without changing the route to manufacture.

## Solution

To allow the greatest parameter space of possible chamber designs to be explored, CFD was used to investigate the flushing characteristics of the separation chamber. Once the simulations had been validated against the original prototype, a series of design studies were conducted to reduce the residence time of the separation chamber.

From this work, C3M were able to make specific recommendations for optimising the chamber geometry which would allow Authentix to reduce the residence time by up to a factor of 5.

The modified design proposed by C3M involved minimal changes to the device fabrication and also helped to reduce the volume of fuel required for the analysis.

## Benefits

Computer simulation allows an organisation the opportunity to investigate a complex design problem in a timely and cost effective way.

Simulation showed that simple design modifications could provide a significant improvement in operational efficiency of a device.

External collaboration increases the network of resources available to an organisation in developing new products and services.